

EXECUTIVE SUMMARY

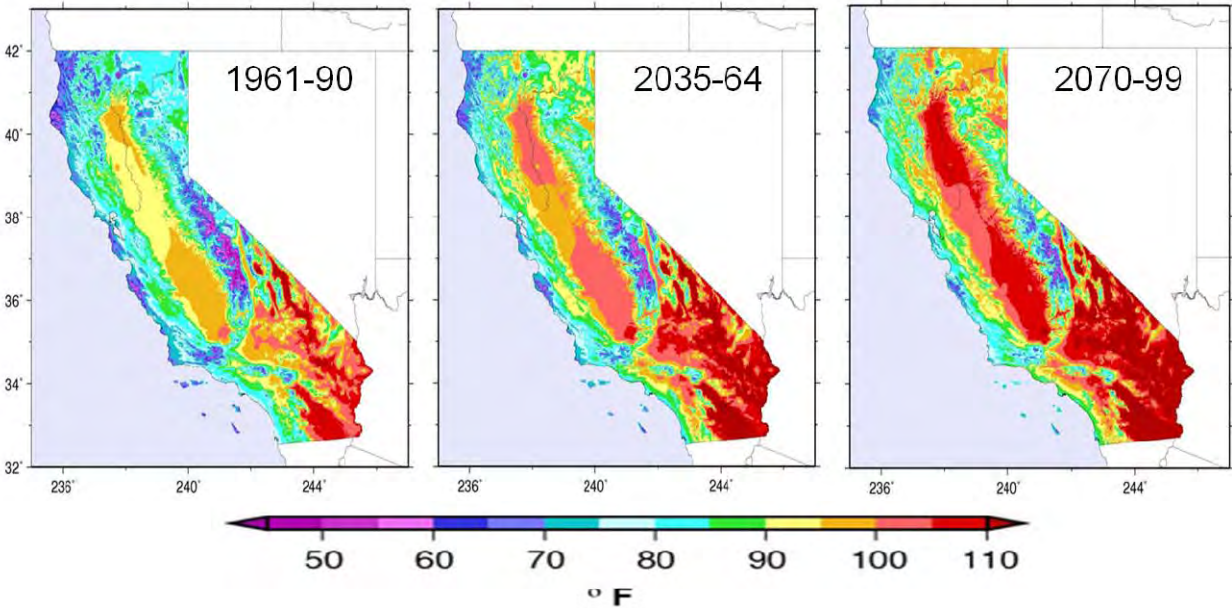
2009 CALIFORNIA CLIMATE ADAPTATION STRATEGY DISCUSSION DRAFT

A Report to the Governor of the State of California
in Response to Executive Order S-13-2008



Public Review Draft

Figure 1. California Historical & Projected July Temperature Increase 1961-2099



Source: Dan Cayan et al. 2009.

TABLE OF CONTENTS

List of Figures and Tables

Executive Summary

Part I – Planning for Climate Change

Page

I. Introduction	11
II. California’s Climate Future	15
III. Comprehensive State Adaptation Strategies	22

Part II – Climate Change - Impacts, Risks and Strategies by Sector

IV. Public Health (Led by the Department of Public Health with assistance from the California Air Resources Board)	33
V. Biodiversity and Habitat (Led by the Department of Parks and Recreation and the Department of Fish and Game)	47
VI. Ocean and Coastal Resources (Led by the Ocean Protection Council)	64
VII. Water Management (Led by the Department of Water Resources).....	77
VIII. Agriculture (Led by the Department of Food and Agriculture and the Department of Conservation).....	90
IX. Forestry (Led by the Department of Forestry and Fire Protection and the Board of Forestry)	105
X. Transportation and Energy Infrastructure (Led by the Department of Transportation and the California Energy Commission)	119

Appendices

A: Executive Order S-13-08.....	132
B: Glossary.....	135
C. Acronyms.....	138

References

LIST OF FIGURES AND TABLES

Figure 1: California Historical and Projected July Temperature Increase 1961-2099

Figure 2: Replacement value of buildings and contents vulnerable to a 100-year coastal flood with a 1.4 meter sea level rise.

Figure 3: Governor Schwarzenegger assessing the site of a recent wildfire

Figure 4: Examples of complementary and conflicting actions between adaptation and mitigation efforts

Figure 5: Historical/Projected Annual Average Temperature for California

Figure 6: Predicted Changes in Northern California Precipitation Levels Show Generally Drier Future

Figure 7: Projected Sea Level Rise over 21st Century

Figure 8: Extreme Climate Drivers and Inter-Sector Interactions

Figure 9: Sample Climate Adaptation Research Needs (2009 CAT Report)

Figure 10: Flow Diagram Showing Public Health Relationships

Figure 11: Increasing Wildfire Risk

Figure 12: Biodiversity and Habitat Figure

Figure 13: Vulnerability of California Coastal Areas to Sea Level Rise

Figure 14: Using Mid-Century Climate Projections to Support Water Resources Decision Making in California

Figure 15: California Historical and Projected Decrease in April Snowpack (1961-2099)

Figure 16: View of Lake Oroville in 2005 and November 2008

Figure 17: California Perennial Crops in a Changing Climate

Figure 18: Modeled Crop Yields by 2100, Shown in 25 Year Increments

Figures 19 and 20: Bark Beetle Damage in California Forests

Figure 21: Increasing Probability of Large Wildfires in California

Figure 22: Projected Increase in Household Electricity Consumption

Figure 23: Peak Electricity Demand June-September 2004

Figure 24: Trains can derail due to extreme heat warping railroad tracks

Figure 25: Projected Sea Level Rise around San Francisco Airport (SFO)

EXECUTIVE SUMMARY

The Golden State at Risk

Climate change is already affecting California. Sea levels have risen by as much as seven inches along the California Coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The state has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year.

These climate driven changes affect resources critical to the health and prosperity of California. For example, forest wildland fires are becoming more frequent and intense due to dry seasons that start earlier and end later. The state's water supply, already stressed under current demands and expected population growth, will shrink under even the most conservative climate change scenario. Almost half a million Californians, many without the means to adjust to expected impacts, will be at risk from sea level rise along bay and coastal areas. California's infrastructure is already stressed and will face additional burdens from climate risks. And as the Central Valley becomes more urbanized, more people will be at risk from intense heat waves.

If the state were to take no action to reduce or minimize expected impacts from future climate change, the costs could be severe. A 2008 report by the University of California, Berkeley and the non-profit organization Next 10 estimates that if no action is taken in California, damages across sectors would result in "tens of billions of dollars per year in direct costs" and "expose *trillions* of dollars of assets to collateral risk." More specifically, the report suggests that of the state's \$4 trillion in real estate assets "\$2.5 trillion is at risk from extreme weather events, sea level rise, and wildfires" with a projected annual price tag of up to \$3.9 billion over this century depending on climate scenarios (www.next10.org/research/research_ccrr.html). The figure at right, from a study by the Pacific Institute, shows coastal property at risk from projected sea level rise by county with replacement values as high as \$24 billion in San Mateo County.

Figure 2: Replacement value of buildings and contents vulnerable to a 100 year coastal flood with 1.4 meters of sea level rise



Source: Heberger et al. 2009.

California understands the importance of addressing climate impacts today. The state strengthened its commitment to managing the impacts from sea level rise, increased temperatures, shifting precipitation and extreme weather events when Governor Arnold Schwarzenegger signed Executive Order (EO) S-13-08 on November 14, 2008. The order called on state agencies to develop California's first strategy to identify and prepare for these expected climate impacts.

The *2009 California Climate Adaptation Strategy Discussion Draft* report summarizes the best known science on climate change impacts in the state to assess vulnerability and outline possible solutions that can be implemented within and across state agencies to promote resiliency. This is the first step in an ongoing, evolving process to reduce California's vulnerability to climate impacts.

The California Natural Resources Agency (CNRA) has taken the lead in developing this draft adaptation strategy, working through the Climate Action Team (CAT). Seven sector-specific working groups led by 12 state agencies, boards and commissions, and numerous stakeholders were convened for this effort. The strategy proposes a comprehensive set of recommendations designed to inform and guide California decision makers as they begin to develop policies that will protect the state, its residents and its resources from a range of climate change impacts. The CNRA will revise this draft adaptation strategy based on public input gathered over the next 45 days.

California's Climate Adaptation Strategy

As the climate changes, so must California. To effectively address the challenges that a changing climate will bring, climate adaptation and mitigation (i.e., reducing state greenhouse gas (GHG) emissions) policies must complement each other, and efforts within and across sectors must be coordinated. For years, the two approaches have been viewed as alternatives, rather than as complementary and equally necessary approaches.

Adaptation is a relatively new concept in California policy. The term generally refers to efforts to respond to the *impacts* of climate change – adjustments in natural or human systems to actual or expected climate changes to minimize harm or take advantage of beneficial opportunities.

California's ability to manage its climate risks through adaptation depends on a number of critical factors including its baseline and projected economic resources, technologies, infrastructure, institutional support and effective governance, public awareness, access to the best available scientific information, sustainably-managed natural resources, and equity in access to these resources.

As the *2009 California Climate Adaptation Strategy Discussion Draft* illustrates, the state has the ability to strengthen its capacity in all of these areas. In December 2008, the California Air Resources Board released the state's *Climate Change Scoping Plan*, which outlines a range of strategies necessary for the state to reduce its GHG emissions to 1990 levels by 2020. Many climate mitigation strategies, like promoting water and energy efficiency, are also climate adaptation strategies. By building an adaptation strategy on existing climate science and frameworks like the Scoping Plan, California has begun to effectively anticipate future challenges and change our actions that will ultimately reduce the vulnerability of residents, resources and industries to the consequences of a variable and changing climate.

To ensure a coordinated effort in adapting to the unavoidable impacts of climate change, the *2009 California Climate Adaptation Strategy Discussion Draft* was developed using a set of guiding principles:

- Use the best available science in identifying climate change risks and adaptation strategies.
- Understand that data continues to be collected and our knowledge about climate change is still evolving. As such, an effective adaptation strategy is “living” and will itself be adapted to account for new science.
- Involve all relevant stakeholders in identifying, reviewing, and refining the state’s adaptation strategy.
- Establish and retain strong partnerships with federal, state, and local governments, tribes, private business and landowners, and non-governmental organizations to develop and implement adaptation strategy recommendations over time.
- Give priority to adaptation strategies that initiate, foster, and enhance existing efforts that improve economic and social well-being, public safety and security, public health, environmental justice, species and habitat protection, and ecological function.
- When possible, give priority to adaptation strategies that modify and enhance existing policies rather than solutions that require new funding and new staffing.
- Understand the need for adaptation policies that are effective and flexible enough for circumstances that may not yet be fully predictable.
- Ensure that climate change adaptation strategies are coordinated with the California Air Resources Board’s AB 32 Scoping Plan process when appropriate, as well as with other local, state, national and international efforts to reduce GHG emissions.

The *2009 California Climate Adaptation Strategy Discussion Draft* takes into account the long-term, complex, and uncertain nature of climate change and establishes a proactive foundation for an ongoing adaptation process. Rather than address the detailed impacts, vulnerabilities, and adaptation needs of every sector, those determined to be at greatest risk are prioritized.

The development of the adaptation strategies presented within this report was spearheaded by the state’s resource management agencies. CNRA staff worked with seven sector-based Climate Adaptation Working Groups (CAWGs) focused on the following areas: public health; ocean and coastal resources; water supply and flood protection; agriculture; forestry; biodiversity and habitat; and transportation and energy infrastructure.

Working group experts have an intimate knowledge of California’s resources, environments, and communities, and also of the state’s existing policy framework and management capabilities. This understanding informs the draft adaptation strategy and ensures a realistic assessment of adaptive capacities, current limitations, and future needs.

A Collaborative Approach

This draft adaptation strategy could not have been developed without the involvement of numerous stakeholders. Converging missions, common interests, inherent needs for cooperation, and the fact that climate change impacts cut across jurisdictional boundaries will require governments, businesses, non-governmental organizations, and individuals to minimize risks and take advantage of potential planning opportunities.

Throughout the development of this report, it became increasingly clear that overlapping missions and goals will require agencies and organizations at all levels to work together to develop close partnerships with regard to climate adaptation. This is the only means by which the far reaching effects of climate impacts can be addressed efficiently and effectively while avoiding potential conflicts. The Comprehensive State Adaptation Strategies chapter underscores the need for collaboration and identifies where cross-sector relationships are necessary.

To further enhance stakeholder participation, seven Climate Adaptation Working Groups (CAWGs) initiated a process that allowed for consultation with stakeholders through public workshops and review opportunities. This input has considerably shaped the content and refinement of this draft report. However, future updates of the draft adaptation strategy will require ongoing input through active stakeholder engagement and an even closer integration of state agency efforts. Public comment gathered during the next 45 days will be incorporated into recommendations and a final version of the report (see www.climatechange.ca.gov/adaptation).

In order to best analyze climate change risks, the *2009 California Climate Adaptation Strategy Discussion Draft* draws on years of state-specific science and impacts research, largely funded through the California Energy Commission's Public Interest Energy Research (PIER) Program and an engaged research community. The research provides for an understanding of the climate-related risks California will face and has significantly contributed to greater public awareness of climate change. As data continues to be developed and collected, the state's adaptation strategy will be updated to reflect current findings.

Preliminary Recommendations

The preliminary recommendations outlined in this draft adaptation strategy were developed by CNRA staff, CAWGs, the CAT, and from public comments. The public comment period will collect input from stakeholders about how these draft recommendations should be modified, if necessary. It is recognized the implementation of the following strategies will require significant collaboration among multiple stakeholders to ensure they are carried out in a rational, yet progressive manner over the long term. These strategies distinguish between near-term actions that will be completed by the end of 2010 and long-term actions to be developed over time, and are covered in more detail in the sector chapters in Part II of this report.¹

¹ Each of the twelve Executive Summary strategies is drawn from multiple strategies within the subsequent sector specific and cross-sector adaptation strategy chapters. The recommendations here may not reflect exact wording of individual sector recommendations but relate to their core message. Each Executive Summary recommendation here lists the sector and recommendation number using the following acronyms to identify the sector: Public Health (PH), Biodiversity

Key recommendations include:

1. A Climate Adaptation Advisory Panel (CAAP) will be appointed to assess the greatest risks to California from Climate Change and recommend strategies to reduce those risks building on California's Climate Adaptation Strategy. This Panel will be convened by the California Natural Resources Agency, in coordination with the Governor's Climate Action Team, to complete a report by December 2010. The CNRA will continue to act as the lead Climate Adaptation Office until subsequent guidance is provided by the CAAP.
2. California must change its water management and uses because climate change will likely create greater competition for limited water supplies needed by the environment, agriculture, and cities. As directed by the Governor, state agencies must implement strategies to achieve a statewide 20 percent reduction in per capita water use by 2020, expand surface and groundwater storage, implement the Delta Vision Cabinet Group recommendations to fix Delta water supply, quality, and ecosystem conditions, support agricultural water use efficiency, and improve state-wide water quality. Improve Delta ecosystem conditions and stabilize water supplies as developed in the Bay Delta Conservation Plan. (BH-2, W-3, 6, and 7; A-3; TEI-3).
3. Consider project alternatives that avoid significant new development in areas that cannot be adequately protected (planning, permitting, development, and building) from flooding due to climate change. The most risk-averse approach for minimizing the adverse effects of sea level rise and storm activities is to carefully consider new development within areas vulnerable to inundation. State agencies should generally not plan, develop, or build any new significant structure in a place where that structure will require significant protection from sea-level rise, storm surges, or coastal erosion during the expected life of the structure. However, vulnerable shoreline areas containing existing and proposed development that have regionally significant economic, cultural, or social value may have to be protected, and in-fill development in these areas should be accommodated. State agencies should incorporate this policy into their decisions, and other levels of government are also encouraged to do so. (CS-2; OCR-1 and 2; W-4; TEI -1).
4. All state agencies responsible for the management and regulation of public health, infrastructure or habitat subject to significant climate change should prepare as appropriate agency-specific adaptation plans, guidance, or criteria by September 2010. (PH-8; BH-1, 2, and 6; OCR-3; F-1 and 2; TEI-2 and 5).
5. All significant state projects, including infrastructure projects, must consider climate change impacts, as currently required under CEQA Guidelines Section 15126.2. (BH-2).
6. The California Emergency Management Agency (Cal EMA) will collaborate with CNRA and the seven sector-based Climate Adaptation Working Groups (CAWGs) to assess California's vulnerability to climate change, identify impacts to State assets, and promote climate adaptation/mitigation awareness through the Hazard Mitigation Web Portal and My Hazards website as well as other appropriate sites. The transportation sector CAWG, led by Caltrans,

and Habitat (BH), Ocean and Coastal Resources (OCR), Water Management (W), Agriculture (A), Forestry (F), Transportation and Energy Infrastructure (TEI), and Cross-Sector (CS).

will specifically assess how transportation nodes are vulnerable and the type of information that will be necessary to assist response to district emergencies. Climate change impacts were recognized in the 2007 State Hazard Mitigation Plan (SHMP) as having an effect on primary hazards such as flooding and wildfires and secondary hazards such as levee failure and landslides. Special attention will be paid to the most vulnerable communities impacted by climate change. (CS-3 and 5; PH-4 and 5; OCR-5; W-4; F-2 and 3; TEI-5, 6 and 8).

7. The State should identify key California land and aquatic habitats from existing research that could change significantly this century due to climate change. Based on this identification the state should develop a plan for expanding existing protected areas or altering land and water management practices to minimize adverse effects from climate change induced phenomena. (BH-1; W-5; F-5).
8. The California Department of Public Health will develop guidance by September 2010 for use by local health departments and other agencies to assess mitigation and adaptation strategies, which include impacts on vulnerable populations and communities and assessment of cumulative health impacts. This includes assessments of land use, housing and transportation proposals that could impact health, GHG emissions, and community resilience for climate change, such as in the 2008 Senate Bill 375 regarding Sustainable Communities. The best long-term strategy to avoid increased health impacts from climate change is to ensure communities are healthy to build resilience to increased spread of disease and temperature increases. (PH-3).
9. Communities with General Plans and Local Coastal Plans should begin when possible to amend their Plans to assess climate change impacts, identify areas most vulnerable to these impacts, and to develop reasonable and rational risk reduction strategies using the Draft California Adaptation Strategy as guidance. Every effort will be made to provide tools to assist in these efforts. (BH-1; OCR– 2 and 4; CS-2).
10. State fire fighting agencies should begin immediately to include climate change impact information into fire program planning to inform future planning efforts. Enhanced wildfire risk from climate change will likely increase public health and safety risks, property damage, fire suppression and emergency response costs to government, watershed and water quality impacts, and vegetation conversions and habitat fragmentation. (PH-4 and 5; F-1; TEI-3).
11. State agencies should meet projected population growth and increased energy demand with greater energy conservation and increased use of renewable energy. Renewable energy supplies should be enhanced through the Desert Renewable Energy Conservation Plan that will protect sensitive habitat that will help reach the state goal of having 33 percent of the state's energy supply from renewable energy by 2020. (TEI-2).
12. Existing and planned climate change research can and should be used for state planning and public outreach purposes; new climate change impact research should be broadened and funded. By September 2010, a user friendly web-based map and interactive website will be developed and regularly updated by the California Energy Commission to synthesize existing California climate change scenario and climate impact research and to encourage its use in a way that is useful for local decision-makers. Every effort will be made to increase funding for climate change research. (CS-4 and 6; PH-7; BH-4; OCR-6; W-8, 9, and 10; A – 8; F-4 and 5; TEI-3 and 9).